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Bulletin 143 April, 1914

West Virginia University
Agricultural Experiment Station
MORGANTOWN, W. VA.

DEPARTMENT OF HORTICULTURE

A Market Garden and Truck Survey

OF THE

Ohio and Kanawha River Valleys

The Sales from This Five Acre Garden in 1912 *Were* $1,254.

BY

ARTHUR L. DACY

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BULLETIN 143

A Market Garden and Truck Survey of the Ohio and Kanawha River Valleys in West Virginia

By A. L. DACY

INTRODUCTION.

The active development of the vast natural resources—lumber, coal, oil, and gas—and the increase in manufacturing which has taken place in West Virginia during the past fifteen years, have had an influence upon economic conditions in the state, the significance of which many of our people have failed to fully recognize. While the population of the state as a whole increased 27.4 per cent between 1900 and 1910, the urban population (those living in places of 2500 or more inhabitants) increased 66 per cent. In five cities in the state the increase was over 100 per cent.

This industrial development has had two effects. It has drawn many of the best workers from the farm—young men between twenty and forty years of age—and has given many farm owners an income, from the sale or lease of their mineral rights, sufficient to remove or greatly reduce the incentive to work their farms. This has lowered production. At the same time it has created in the cities, lumber camps and mining towns some of the best possible home markets for the products of the farm. The resulting condition is of vital interest to every citizen of the state. To those who live in the cities and towns it means that the cost of their daily food is constantly increasing. To the farmers of the state it means an opportunity to derive larger incomes from their farms if they will produce more of the kind of crops that are most in demand, namely, vegetables.

According to the 1910 census the value of the vegetable products of the state in 1909, including Irish and sweet potatoes, was approximately $7,000,000. This was more than

twice the value of all the tree fruits, berries and grapes produced in the same year; nearly twice the combined value of the wheat and oat crops; nearly equal to all the hay and forage grown, and but little less than the value of all the coke made at the mines in the state in 1909. The average acreage devoted to the potato crop in that year was about half an acre to the farm and that devoted to all vegetables other than potatoes, was a little less than half an acre. The facts are, however, that in spite of the large aggregate value of the vegetables produced, they are by no means sufficient to supply the demand of our markets. To do this it is necessary to send, each year, several millions of dollars to gardeners in other states for vegetables, a large portion of which can be grown in our state at a greater profit per acre than the usual farm crops. *

To serve as a basis for the further study of the problems affecting the market gardening and trucking industry in the state, a survey of the Ohio and Kanawha River valleys was made last summer by the writer, assisted by Mr. R. R. Jeffries, an Assistant Horticulturist of the Experiment Station. Each investigator spent three weeks in the field securing data from those actually working the land in those valleys. This section of the state was chosen because its natural advantages make it the logical center of this industry. It is the purpose of this bulletin to describe briefly the present extent of this industry. In addition an analysis will be made of the factors affecting the industry and some suggestions will be offered as to ways and means of increasing its development.

*According to statistics gathered by the Station from dealers in seventy-six towns, there were shipped into and sold in West Virginia between September 30, 1908, and October 1, 1909, fresh vegetables valued at $2,558,276 and canned vegetables valued at $2,479,251, a total of $5,037,527. (Report of Experiment Station for 1909-10).

According to the figures of the United States Census for 1910 the average farm value per acre of the principal farm crops was as follows, in 1909:

Tobacco	$107.27	Wheat	$ 12.89
Vegetables other than potatoes	103.08	Hay and forage	10.57
Sweet potatoes and yams	81.81	Buckwheat	10.54
Irish potatoes	53.46	Oats	8.79
Corn	17.61	Rye	7.80

EXTENT OF THE SURVEY AND METHOD OF MAKING THE SAME.

With the exception of several miles of bottoms found on Short, Cross, and Buffalo Creeks above Wheeling; on Big, Little, and Middle Wheeling Creeks leading into Elm Grove; and the hill section between Elm Grove and Sherrard: the survey was confined to the bottom lands along the Ohio and Kanawha Rivers.

As far as possible each farm on the bottoms was visited, the man operating the farm was interviewed and his replies recorded on a blank (one for each farm). To give an idea as to the information sought, a copy of the question blank follows.

MARKET GARDEN AND TRUCK SURVEY

WEST VA. AGRICULTURAL EXPERIMENT STATION

Survey No. ..... *Date* ..... *191*...

County ..... *P. O.* .....

Name .....

Tenant, Owner; Nearest R. R. Sta. .....

Soil types and area .....

.....

.....

Location of trucking land .....

.....

Drainage .....

.....

Principal Crops	Area of Each	Returns

Commercial Fertilizer .....

.....

Stable manure, source .....

Cost ..... *Hauling* .....

Amount used .....

Cover crops .....

.....

Crop rotation .....

.....

Markets .....

How is crop sold? .....

Packages .....

Are returns satisfactory? .....

Greenhouse .....

Sash .....

Insect pests .....

.....

Plant diseases .....

.....

Spraying .....

Save own seed .....

Suggestions .....

.....

.....

.....*Observer* .....

Throughout the entire survey the writer and Mr. Jeffries were met with the utmost courtesy by the farmers and gardeners, and all questions were cheerfully answered as far as it was possible to do so. *

*The author and colleague are indebted to Messrs. W. H. Sill, H. S. Vandervort, and B. B. Ezell, County Agricultural Agents for Brooke and Ohio, Wood, and Kanawha Counties, respectively, for assistance in locating the gardeners in their particular sections.

PRESENT EXTENT OF THE INDUSTRY.

In describing the present development of the industry in the valleys, it will be considered in sections represented by the type of gardening that is carried on in each. The first to be described is the Northern Pan Handle from Chester in the extreme north to Moundsville in the southern end. This section includes the most centralized industrial development in the state. In it is located the largest city in the state—Wheeling—and with several others of good size found in the area, includes nearly half the population found in the cities and towns within the entire survey, as shown in Table I, page 15.

Fig. 1. *A Market Garden Farm on Big Wheeling Creek.*

It is only natural therefore that the most highly developed market gardening industry is found in this section, principally in the neighborhood of Wheeling on the bottoms along the creeks already referred to. In the Northern Pan Handle section there were found sixty-five market gardeners operating a total of about six hundred and thirty acres. The individual farms varied from two to twenty-five acres, the average being about ten acres. On the hills southeast of Wheeling toward Sherrard eight farmers were interviewed who between them were growing thirty-six acres of truck for the Wheeling market. The names of twenty-five others were secured. The area in vegetables grown on these hill farms averaged about five acres, it being a sort of side line to other types of farming. The

growers on the bottoms grow a large variety of vegetables in succession, a few being equipped with small greenhouses and the majority of them with hot-bed sash, varying from ten to over one hundred in number, for starting or maturing early crops. Located as they are, within driving distance of their markets, they are in the market with something to sell at least two or three times a week, and sometimes daily, depending upon the season of the year. They were practically unanimous in preferring to sell their products at wholesale to the retail dealers. In sharp contrast to this was the custom of the hill farmers referred to. They do not grow as great a variety of

Fig. 2. *The House on This Market Garden Farm is Shown in Fig.* 3.

crops and prefer to sell at retail twice a week from stalls in the public market located in the southern end of Wheeling. Some typical homes and gardens of this section are shown in figures 1, 2, and 3, and on the cover page.

Between Moundsville and New Martinsville, fourteen farmers were interviewed who were operating farms averaging approximately one hundred and twelve acres, a total of fifteen hundred and seventy-six acres, of which at least half was bottom land. The only vegetables grown on these bottoms were potatoes of which there was a total of forty-eight acres. The other crops were corn, wheat and hay.

In the vicinity of New Martinsville, five growers were found who were making a specialty of early tomatoes in addi-

tion to a somewhat general line of vegetable crops. Their total acreage was fifty-eight acres. Most of their product was handled by the wholesale produce house at New Martinsville. *Near St. Marys three farmers were found who between them were growing fourteen acres of potatoes, thirteen acres of watermelons, three acres of sweet corn, and one acre of beans, a total of thirty-one acres. Between St. Marys and Williamstown seven men were interviewed who, between them were growing twenty-seven acres of Irish potatoes and seven acres of miscellaneous vegetables.

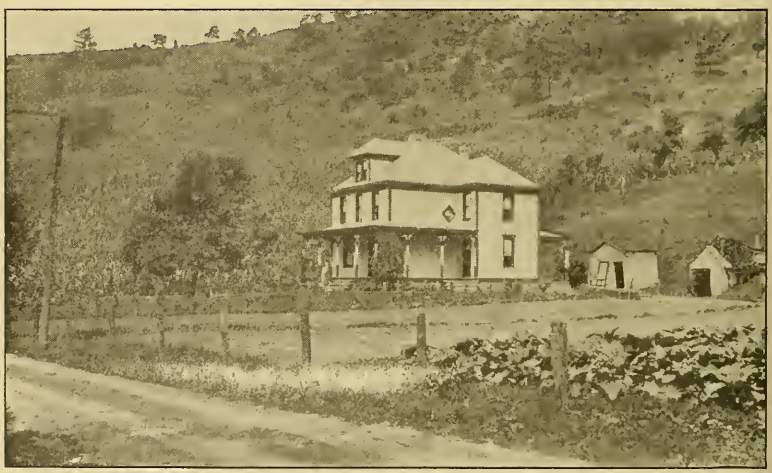

Fig. 3. *The Home of a Successful Market Gardener on Middle Wheeling Creek.*

On the bottoms about Williamstown eleven growers were interviewed who were working a total of fifty-six acres. Only two of this number were growing a general line of vegetables. The others were specializing in early tomatoes and cabbage, cucumbers, muskmelons, watermelons, sweet corn, and potatoes. Their produce was shipped to Marietta, Ohio, just across the river, on the interurban express car and sold at wholesale in that city.

*Owing to a misunderstanding the section between Sistersville and St. Marys was not visited. Through correspondence with the farmers living in this part of the valley it was found that general farming or dairying are the principal types carried on. A few acres of potatoes were the only vegetables grown for sale. There are fine bottoms of Wheeling gravelly loam at Long Beach and Bens Run.

As one approaches Parkersburg along the interurban electric line connecting that city with Marietta, Ohio, he finds another well developed market gardening section on what is called the Sand Plains at the northern border of the city. Sixteen growers were interviewed who between them were cultivating one hundred and eight acres in vegetables, for the Parkersburg market. This market also receives a considerable bulk of produce from Belpre, Ohio, just across the Ohio River. Of the sixteen growers interviewed, six preferred to sell at retail, eight at wholesale and two sold both at wholesale and at retail. A few miles north of Parkersburg a canning factory has been in operation the past two seasons. Tomatoes have been the product packed and the farmers in that section have grown a considerable acreage both seasons for the cannery.

A few miles south of Parkersburg on the Washington bottoms, eleven farmers with a total holding of eight hundred and ninety-four acres were interviewed. Of this area the total area planted to vegetables was fifty-six and one-half acres. It was divided as follows: Irish potatoes, thirty-three acres; melons, five acres; sweet corn, seventeen acres; and miscellaneous, one and one half acres. They were all marketing at Parkersburg at both wholesale and retail.

On the Belleville bottoms, six farmers were found who between them were growing twenty-three and one half acres of potatoes which they disposed of in the Parkersburg and Pittsburg markets.

In the vicinity of Ravenswood eleven growers had planted in watermelons fifty-five and one half acres, muskmelons one and one half acres, sweet corn six acres, Irish potatoes seventeen and one half acres, and miscellaneous vegetables four acres, a total of 84½ acres. These products were all disposed of at wholesale in Ravenswood and Spencer, with the exception that one man having six acres of watermelons and fifteen acres of potatoes shipped to Pittsburg.

On the bottoms at Willow Grove and at Millwood ten growers were caring for a total of 164½ acres of vegetables, divided as follows: watermelons forty-six acres, muskmelons nine acres, Irish potatoes one hundred and two and one half

acres, sweet corn three acres, and tomatoes four acres. These products were sold at wholesale in the markets of Huntington, Spencer, Parkersburg, Wheeling, and Pittsburg.

Fig. 4. *The Above Map and That on the Opposite Page Show the Location of the Principal Bottoms Along the Ohio River.*

General farming is the prevailing type on the bottoms at Letart which comprise about six hundred acres. Three of the thirteen farmers operating on this area were growing between them about twenty acres of potatoes for market, the product

Fig. 5. *The Number Beneath the Names of the Bottoms Refer to the Corresponding Numbers on the Left of Table* III *and Designate the Prevailing Type, or Types, of Soil Found on Each Bottom.*

being sold usually to local buyers or shipped to Huntington, Charleston, Wheeling or Pittsburg. The crops grown by the others are principally corn, wheat and hay. At the next station below (Graham) there are several bottoms on which a considerable acreage of potatoes is grown each year. Of the eleven farmers interviewed, ten of them cultivated one hundred and sixteen acres in 1913. In addition four of them cultivated fourteen and one half acres of watermelons; total 130½ acres. These growers shipped their product to Hartford and Huntington, W. Va., Racine, Pomeroy, Zanesville, and Middleport, Ohio, and Pittsburg, Pa. That sold in the nearby Ohio towns was retailed.

Near New Haven, three growers had twenty-five and one half acres of potatoes. Some of the bottoms at this point and at Mason are used by the Gold Nursery Company of the latter city for growing nursery stock.

On the bottoms at Spillman and Maggie ten growers were interviewed. Between them they were cultivating twenty-three and one half acres of Irish potatoes, seventy-eight acres of watermelons, two and one quarter acres of muskmelons and ten and one half acres of sweet corn; total 114¼ acres. The bulk of this produce was marketed at wholesale in Pomeroy and Middleport, Ohio; the balance in Huntington, Charleston and Wheeling.

In the vicinity of Point Pleasant the Point Pleasant Nursery Company occupies a considerable area of bottom land with its young nursery stock. Twelve growers were interviewed in this section. Between them they were growing one hundred and thirteen and one half acres of watermelons, thirty-three acres of muskmelons, four acres of Irish potatoes, twenty-three acres of sweet corn, and eight acres of miscellaneous vegetables; total 118½ acres. The bulk of their product is disposed of at wholesale at Gallipolis and Middleport, Ohio, and at Point Pleasant and Charleston, W. Va.

Below Point Pleasant on the Ohio River at Gallipolis Ferry, Beal, Apple Grove, Mercer's Bottom, and Lesage, were found eleven farmers who were growing between them fifty-one acres of watermelons, two and one quarter acres of musk-

melons, six acres of Irish potatoes, four and three quarters acres of sweet corn, five and one half acres of tomatoes and four and three quarters acres of miscellaneous vegetables; a total of 74¼ acres. These growers look to Gallipolis, Ohio, and Huntington and Charleston, W. Va., for their markets, the bulk of their crops being sold at wholesale.

At Guyandotte and in the outskirts of Huntington, Ceredo and Kenova seventeen growers were interviewed, all of whom were growing truck for these markets, particularly Huntington. The crops being grown by these men were as follows: sweet corn thirty-six acres, Irish potatoes ten acres, beans ten and three quarters acres, tomatoes six and one half acres and miscellaneous vegetables sixteen and one half acres; total 79¾ acres.

In the Kanawha River valley a total of twenty-seven farmers and gardeners were interviewed. The crops planted by them were divided as follows: sweet corn seventy-seven acres, tomatoes forty acres, Irish potatoes twenty-six acres, beans eleven acres, watermelons twenty acres, muskmelons ten acres, and miscellaneous vegetables twenty-nine acres, or a total of 213 acres.

The total acreage in both valleys of which a record was made was 2,168, divided approximately as follows: Irish potatoes 497 acres, watermelons 396 acres, muskmelons 58 acres, sweet corn 180 acres, tomatoes 56 acres, beans 21 acres, and miscellaneous market garden vegetables 960 acres. The record was secured from 271 farmers and gardeners. The average gross receipts per acre from all market garden crops as given by the gardeners interviewed varied from $100 to $250 per acre, while the average gross receipts per acre received from all truck crops varied from $50 to $150 an acre.

FACTORS AFFECTING THE DEVELOPMENT OF THE INDUSTRY.

There are several factors to which any man who wishes to begin the market gardening or trucking business should give careful consideration. These are; markets, transportation facilities, climatic and soil conditions, cost of land, and the supply and cost of labor. These factors have of course an equally important bearing upon the development of the industry in any given section. The writer therefore proposes to discuss them from the standpoint of both the present and the future of the region embraced in this survey. They will be taken up separately in the above order.

Fig. 6. *An Open Square in Wellsburg. Many Acres of the Best Types of Gardening Soils are Rapidly Being Used for Residential Purposes in the Northern Pan Handle.*

Markets.

Reference was made on page 3 to the fact that during the past fifteen years the urban population of West Virginia has increased very rapidly. Part of this increase has taken place within the area considered in this bulletin. The following table gives the names of the principal incorporated towns and cities situated in the Ohio and Kanawha River valleys, the counties in which they are located and their population in 1900 and in 1910 as given by the United States Census.

Table I. *Showing the population, in* 1900 *and* 1910, *of the principal cities and towns within the area included in the survey*:

CITY OR TOWN	COUNTY	Population in 1910	Population in 1900
Benwood	Marshall	4976	4511
Charleston	Kanawha	22996	11099
Elm Grove	Ohio	1899	768
Follansbee	Brooke	2031	
Fulton	Ohio	1038	
Guyandotte	Cabell	1702	1450
Huntington	Cabell	31161	11923
Kenova	Cabell	992	863
McMechen	Marshall	2921	1465
Mason	Mason	784	904
Moundsville	Marshall	8918	5362
New Cumberland	Hancock	1807	2198
New Martinsville	Wetzel	2176	1089
Parkersburg	Wood	17842	11703
Point Pleasant	Mason	2045	1934
Ravenswood	Jackson	1081	1071
St. Albans	Kanawha	1209	816
St. Marys	Pleasants	1358	825
Sistersville	Tyler	2684	2979
Wheeling	Ohio	41641	38878
Wellsburg	Brooke	4189	2588
Williamstown	Wood	1139	
	TOTALS	156589	102426

These figures, as striking as they are in some instances, by no means tell the whole story as to the markets that are available to the growers in these valleys. In the first place the figures are not up to date. To illustrate: four years ago, in the summer of 1909, as the writer journeyed down the valley he noticed shortly before reaching Wheeling Junction, on a piece of rising ground facing the river, a lot of stakes set as if marking the boundaries of streets and town lots. Inquiry led to the fact that it was proposed to build a large manufacturing plant at this place and the stakes were the first evidences of the town that was to be located there later. Last summer, upon reaching this spot the writer found Weirton, a thriving town of three thousand two hundred people and still growing rapidly. He was told by the Station Agent that practically all of the produce sold in the town was received through the

wholesale produce houses of Steubenville, Ohio. Inquiries at the stores in the town led to the discovery of but two local men who were bringing vegetables into the town. This in spite of the fact that the town is within half a mile of several hundred acres of fine bottom land. The reason for this state of affairs will be discussed under "The Cost of Land."

In the second place the figures do not disclose the fact that several of the cities and towns given in the above list are distributing centers for large areas in which are many small towns situated in some instances at a considerable distance from these centers. Thus, Huntington, Charleston, Point Pleasant, Parkersburg, New Martinsville, Moundsville, and Wheeling, through their wholesale produce dealers reach many times their own population. In addition to the cities and towns listed, Pittsburg, Pennsylvania, but sixty-eight miles north of Wheeling, with its population of over half a million people, is a splendid outlet for any surplus which may be grown in the Ohio Valley.

The fact that the question "Are returns satisfactory?" was answered in the affirmative by practically every farmer interviewed, is the best possible indication that this section has good markets for farm produce.

Transportation Facilities.

Very intimately associated with the market factor is that of the facilities for reaching these markets. The Ohio and Kanawha River valleys are very fortunate in this respect. The Ohio, Kanawha, and Little Kanawha Rivers giving direct connection between the largest cities of the area and with Pittsburg, afford the most economical transportation possible. At present they are not used as much as they should be for marketing farm products because, owing to slack water in the Ohio at some seasons of the year, the river is not navigable the year round. This results in somewhat irregular service by the river boats. It is a question of but a few years, however, when the locks and dams now building will make the river navigable the year round. This will doubtless lead to a more general use of the river for moving farm supplies and farm products.

The region is well supplied with railways. The Ohio

River division of the Baltimore and Ohio Railroad parallels the Ohio River from Kenova to Wheeling, and the Pan Handle road, one of the Pennsylvania lines, extends up the valley from Wheeling to Chester. Direct connection is made with Pittsburg by both systems. Connections are also made with points East and West on the Baltimore and Ohio Railroad at Wheeling and Parkersburg. Other branches connect towns in the valley with those in the interior of the state, such as: New Martinsville and Clarksburg; Ravenswood and Spencer; and Millwood and Ripley. The Little Kanawha Railroad parallels the Little Kanawha River and connects Parkersburg with Palestine in Wirt County. The Kanawha & Michigan Railroad enters the valley at Point Pleasant and parallels the Kanawha River as far as Gauley Bridge, thirty-seven miles beyond Charleston. Kenova and Huntington are connected with Charleston by the Chesapeake & Ohio Railroad, and the Norfolk & Western Railroad passes through the former town, running east through a rich coal mining section.

There are several interurban electric lines within the area: namely, from Wheeling to Steubenville, Ohio, via Wellsburg and Follansbee; from Wheeling to Moundsville; from New Martinsville to Sistersville; from Parkersburg to Williamstown and Marietta, Ohio. These are all equipped with an express service which affords a quick and economical means of moving farm products to the larger centers of population. Other lines are already projected and further facilities will be added by the transportation companies already operating in the area whenever the need for them is demonstrated.

Climate.

Climate, with its varying degrees of temperature and moisture supply, determines to a large degree the crops that can be *profitably* grown for *market* in a given region. The region included in this survey lies between approximately 38° 30′ and 40° 30′ north latitude. This is practically the same as that part of the Atlantic coast included between Salisbury, Maryland, on the south and New York City on the north, although the northern limit to the larger portion of the area corresponds with the latitude of Philadelphia, which is about the same as that of Wheeling.

The annual mean temperature of the section is about 54°. The winters are not severe, the temperature in the Northern Pan Handle seldom falling below 10° above zero. Snowfall is moderate, rarely remaining long at a time. The summers are warm and pleasant but not excessively hot. The length of the growing season is about six and a half months, the dates of the last killing frost in the spring ranging from April 10th to 17th and the first killing frost in the autumn from October 1st to 28th.

The average annual rainfall for the section is about forty inches, and is usually well distributed throughout the growing season.

From the standpoint of climate the growers in this section can compete successfully with all except those situated in such sections as the Eastern Shore of Virginia and points on the Atlantic coast line to the South and the trucking sections of Tennessee, Kentucky, Arkansas, Mississippi, Louisiana, and Alabama. Even this competition should be limited strictly to the very earliest products of the season.

Soils.

The work of this survey was greatly facilitated by the use of soil maps covering the region. Because of their great value to any person interested in the soils of this section they will be described at some length. These soil surveys* have been made by agents of the Bureau of Soils of the United States Department of Agriculture, in twenty-five counties of the state, in co-operation with the West Virginia State Geological Survey. From one to three counties are included in separate areas, which are usually named for the most prominent city or town of the area. The following table gives the names of the areas in West Virginia already surveyed, the counties included and the date of the report of each survey.

*The reports of each survey are published by the U. S. Department of Agriculture as "Advance Sheets—Field Operations of the Bureau of Soils." Copies of these may be obtained free through our State Congressmen. They are also published by the West Virginia State Geological Survey as part of their County Reports. Each County Report in addition to the soil survey, includes topographical maps and information relating to the geology and mineral resources of the area. They may be obtained from the office of the Geological Survey at Morgantown at $1.75 to $2.50 a volume.

Table II. *Showing the areas surveyed, the counties included in each area and the year in which the report was published:*

Name of Area		Counties Included in Area	Date of Report
Jefferson Co.		Jefferson	1903
Upshur Co.		Upshur	1906
Wheeling	Area	Ohio, Brooke and Hancock	1906
Middlebourne	"	Marshall, Wetzel and Tyler	1909
Parkersburg	"	Pleasants, Wood and Ritchie	1910
Spencer	"	Wirt, Roane and Calhoun	1911
Point Pleasant	"	Jackson, Mason and Putnam	1911
Clarksburg	"	Doddridge and Harrison	1912
Morgantown	"	Marion, Monongalia and Taylor	1913
Huntington	"	Cabell, Wayne and Lincoln	1913

The report of the survey of each area includes a general description of the area with brief historical notes and information as to the climate of the area and the types of farming carried on therein. A most important part of each report deals with the soils of the area. It gives the name, total area, location, origin, and mechanical analysis of each type of soil found in the area and describes the best method of management and the crops best adapted for each type. A large map accompanies each report on which each different type of soil found in the area is printed in its particular color. This enables anyone at a glance to be informed as to the type of soil found in any part of the area in which he may be interested.* It will be seen from the above list that all of the counties covered in this market garden and truck survey have been mapped, and these maps enabled the writer and Mr. Jeffries to cover the ground much quicker than would have been possible had they not been available. The following table gives the names and areas of the various types of soils found in the bottoms of the Ohio and Kanawha River valleys and on the adjacent hills with their locations as given in the reports of the different areas. Those types given in the first part of the table are best suited for the growing of truck crops, because of their physical texture, location, etc. The second part of the table includes the types which may be used for truck crops, but which because of their texture or location are not as well adapted to this class of crops as the preceding types.

*Figures 4 and 5 have been adapted from the different soil survey maps covering the two valleys.

TABLE III. *Showing the number of acres of each soil type that are found in each area, the total acreage of each type found in the section included in this survey and the total of all types in each different area:*

Part 1.

NAME OF SOIL TYPES	Hancock, Brooke & Ohio Counties	Marshall, Wetzel & Tyler Counties	Pleasants, Wood & Ritchie Counties	Jackson, Mason and Putnam Counties	Cabell, Wayne and Lincon Counties	Total of Each Type
1. Huntington loam	8576 acres	25152 acres		4480 acres	1152 acres	39360 acres
2. Huntington fine sandy loam	1536 "	640 "			22272 "	24448 "
3. Wheeling gravelly loam	1472 "	2240 "	320 acres	768 "		4800 "
4. Wheeling sandy loam	576 "	192 "		1152 "		1920 "
5. Wheeling fine sandy loam			1344 "	3584 "		4928 "
6. Wheeling silt loam		2816 "	5696 "	9152 "	3904 "	21568 "
7. Wheeling silty clay loam					3392 "	3392 "
8. Wheeling fine sand			2624 "	1280 "	256 "	4160 "
9. Holston fine sandy loam					2624 "	2624 "
10. Holston silt loam				25856 "	22080 "	47936 "
11. Holston silty clay loam					13248 "	13248 "
12. Moshannon silt loam				22272 "		22272 "
TOTALS	12160 "	31040 "	9984 "	68544 "	68928 " *	190656 "

TABLE III.
Part 2.

13. Huntington silt loam					37440 acres	37440 "
14. Huntington silty clay loam			40832 "			40832 "
15. Dekalb loam	27008 acres	24512 acres				51522 "
16. Dekalb sandy loam	1920 "					1920 "
17. Dekalb silt loam	23424 "	3712 "	54592 "	74752 "	3392 "	159872 "
18. Dekalb loamy sand				448 "		448 "
TOTALS	52352 "	28224 "	95424 "	75200 "	40832 "	292034 "

*A considerable portion of these soils are found in the Teays valley, between Huntington and Charleston and along the bottoms on Mud River and Twelve-pole Creek in Wayne and Lincoln Counties. Owing to lack of time these were not included in the market garden survey but are given here because conditions are very similar to those found in the two

As one follows the winding course of the Ohio River from north to south he finds the area between the river and the hills to be of varying widths. In many places the hills rise abruptly, leaving hardly more than enough room for the railroad to pass between them and the river-banks. Such places may be followed by bottoms a few hundred feet wide, while in other instances they may extend a mile from the river to the hills and up and down the valley for several miles, covering an area of several hundred acres. The bottom lands along the Kanawha are more uniform, averaging about a mile in width.

The bottoms are characterized by quite well defined terraces of various widths the height of one above the other varying from five to twenty feet. They are locally known as "first," "second" and "third" bottoms. The "first" bottoms along the Ohio River and its tributaries in the northern part of the valley are composed principally of the Huntington series. Along the Kanawha they are mostly of the Moshannon silt loam. Of the Huntington series the Huntington loam, while it is a "first" bottom soil and subject to overflow every spring, is found high enough above the normal level of the Ohio River to preclude damage to crops from this source during the growing season. For this reason it is included in the first part of Table III. It is well adapted to the coarser types of vegetables such as potatoes, tomatoes, etc. The Huntington silt loam, silty clay loam and fine sandy loam are subject to annual overflow in the spring and often later in the season. It is because of this fact that the first two of these soil types are given in the second part of Table III. They are planted almost exclusively to corn each year, a crop which suits them so well that it would be unwise except in a few places, to change this practice. The last named is given in the first part of the table because of its better adaptability to truck crops and its nearness to good markets.

The Moshannon silt loam which is confined to the "first" bottoms along the Kanawha River is high enough above the level of the stream to preclude danger from a disastrous overflow during the growing season and for this reason is included in the first part of Table III.

Further removed from the Ohio River the "second" and "third" bottoms are found, made up for the most part of the different types of the Wheeling series. They represent materials that were deposited by the river when it was flowing at much higher levels. They are by far the best types for early truck crops, since they are not subject to overflow and their texture is such as to allow of early planting.

The soils of the Holston series as given in Table III, it will be noticed, lie entirely within the last two areas, the Holston fine sandy loam and silty clay loam being confined to the last area. These types are found as second bottoms along the tributaries of the Ohio River usually above the overflow and are well adapted to the heavier truck crops. The Holston silt loam which is about equally divided between the two areas occurs largely in the Teays valley (the ancient bed of the Kanawha River) upon the ancient terraces of this river and also upon the ancient terraces of the Ohio River between Point Pleasant and New Haven in Mason County and between Ravenswood and Millwood in Jackson County. Its elevation ranges from 100 to 200 feet above the present "first" bottoms of these streams. The soils of this series are very well adapted to the growth of truck crops.

The soils of the Dekalb series, one or more types of which are found in each area, occur as upland, residual soils which have been formed by the weathering, in place, of the sand-stones and shales of the region. They are not strong soils naturally, and in many cases they have been depleted of their organic matter by continual cropping. They are very well adapted to the growth of certain truck crops(particularly the later, coarser sorts) and are very much lower in price than the bottom lands. For these latter reasons they are included in Table III although the former characteristics have caused them to be placed in the second part of the table.

The relative value of the above mentioned soils for market garden purposes is determined in a large degree by the texture; that is to say, by the size and arrangement of the soil particles. The variation in the physical texture of the different types of soil is brought out quite clearly in the following

table which presents in tabular form the mechanical analyses of samples taken by the soil surveyors. To the gardener these analyses are even more important than the chemical analyses would be, as will be shown in the discussion of the table.

NAME OF SOIL TYPE	Point at which Sample was Taken	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt	Clay
		Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
untington fine sandy loam	Huntington	.0	.7	5.2	33.7	24.1	28.6	7.7
heeling gravelly loam	Pt. Pleasant	16.1	16.2	8.3	9.4	4.0	26.8	18.9
heeling sandy loam	" "	3.0	26.3	30.7	7.5	6.7	18.4	7.1
heeling fine sandy loam	" "	0.8	8.2	7.7	29.8	16.	28.	8.9
heeling silt loam	" "	0.1	0.8	1.3	3.2	8.2	59.	27.3
heeling silty clay loam	Huntington	0.0	0.4	0.7	4.5	8.4	65.9	20.5
heeling fine sand	Parkersburg	0.2	5.6	33.5	33.4	8.8	13.3	5.1
olston silt loam	Pt. Pleasant	0.3	1.0	1.2	4.2	3.0	78.5	11.2
olston fine sandy loam	Huntington	0.0	2.8	17.	40.7	9.9	20.5	8.9
olston silty clay loam	Huntington	0.0	0.3	0.9	4.6	6.1	62.	26.3
oshannon silt loam	Pt. Pleasant	0.2	0.8	2.1	9.5	6.9	62.6	17.8
untington silt loam	" "	0.0	0.1	0.6	4.5	5.9	68.6	20.
untington silty clay	" "	0.0	0.1	0.0	1.3	3.1	67.2	28.
untington loam	" "	0.0	0.4	4.5	27.8	15.1	38.6	13.4
ekalb silt loam	" "	0.2	1.0	1.1	4.4	4.	75.3	13.6
ekalb loamy sand	" "	0.4	11.4	31.6	27.7	5.8	15.1	7.7
ekalb loam	Wheeling	0.9	2.5	1.3	2.5	9.2	58.8	24.5
ekalb sandy loam	Wheeling	1.1	10.3	19.9	16.1	10.3	25.4	15.9

In the above table attention is called to the last two columns, in particular, as the percentages of silt and clay found therein serve as a basis for dividing the soils into two general classes; first, those in which the silt and clay together constitute from 83% to 90% of the soil and, second, those in which the silt and clay together constitute from but 18% to 52% of the soil.

It may be said of the first class of soils, that in general they are inclined to be cold, heavy, compact soils which warm up slowly in the spring, are too wet to be plowed early, break up cloddy if plowed too wet, are inclined to bake after a rain and are difficult to work. The use of the soils of this class should be restricted to the later, coarser crops, such as Irish potatoes, tomatoes and beans for canning purposes, cabbage, brussels sprouts, celery, sweet corn, and kale—all of which should do well on these soils.

Soils of the second class, because of their larger percentages of the coarser particles, warm up more quickly in the spring, can be plowed and planted earlier, favor early maturity, do not bake after a rain, and are easily worked at all times. They require large amounts of vegetable matter and are apt to suffer for moisture in times of drouth. This class of soils contains the best market garden soils in the state and should be more largely used for such crops. Early sweet corn, peas, beans, rhubarb, tomatoes, potatoes, cabbage, and cauliflower; also spinach, beets, radishes, carrots, onions, lettuce, asparagus, sweet potatoes, cucumbers, muskmelons, watermelons, egg plants, and peppers could be profitably grown on this class of soils.

The *prevailing type of soil in any community* should determine in a large measure the kinds of crops to be grown there, particularly if it is necessary to ship the products any considerable distance to market. If all the farmers in a given section will grow the crop, or crops, for which the prevailing type of soil in their community is best adapted, their marketing problem will be greatly simplified since this will enable them to ship in carload lots and thus become a factor in the market.

Cost of Land.

Figures 6 to 12 illustrate very strikingly a condition found in the Ohio River valley from Moundsville northward; namely, the gradual crowding out of the market garden industry, caused by the industrial development which is taking place in this section; the consequent advance in the price of land, which varies from $500 to $3,000 an acre; and its use for residential and manufacturing-site purposes. The writer was repeatedly told that the present gardening operations are as nothing compared with what was formerly carried on in this section and it is his opinion that it is a question of but a few years, if the present development continues, when there will be little if any market gardening done in this part of the valley. In the greater part of the Northern Pan Handle the area between the hills (which in many cases rise quite abruptly to a considerable height) and the river is compara

tively narrow. This means that the cities and the towns in the area will continue to spread up and down the river bottom. Figure 7 was taken by the writer in the summer of 1909. It shows a part of what was at that time one of the largest market garden farms in the neighborhood of Wheeling. The

Fig. 7. *View of a Market Garden Farm in the Ohio Valley Above Wheeling. Photograph Taken in Summer of* 1909. *Contrast With Fig.* 8.

owner has done very little gardening since 1909, the only crop planted in 1913 being four or five acres of sweet corn. Figure 8 is a view which the writer took last summer from the same spot from which he took that shown in figure 7. In the four years that have intervened, this suburb of Wheeling which is shown in the picture has pushed up to the very edge of this farm which now is laid out into streets, with cement sidewalks, awaiting development. But a little farther north the largest gardeners in this section (a firm of three brothers) are almost entirely surrounded by houses and their land is of such value that the days of its use for its present purposes are numbered. See figures 9, 10 and 11. Figure

12 is the picture of an industrial plant typical of this section occupying acres of bottom land which in many cases were formerly producing vegetables for the markets of this section.

While market gardening skillfully conducted, will pay dividends on higher priced land than almost any other kind

Fig. 8. *Photograph Taken in Summer of* 1913 *from the Same Spot as the View Shown in Fig.* 7.

of farming, it is subject to the same economic laws as business in general, and the growers in this section cannot long compete successfully with those who are located on cheaper lands, even though at a considerable distance from their markets. They will be obliged to move further down the valley, further back on the creeks leading into the valley, or else take to the hills. So far as the writer could ascertain there has been but little increase in the number of gardeners on the creeks leading into the valley in this section. The rather limited area of bottom land on most of these creeks (with the exception of Buffalo Creek) is probably the reason for this. There has undoubtedly been a considerable increase in recent years in the acreage planted on the hills in the region. The types of soil found on these hills together with the difficulty of hauling manure up onto them has no doubt prevented this change from taking place more rapidly. The logical development in the opinion of the writer would be to extend the industry further down the Ohio River valley.

There are hundreds of acres of soil of the types adapted to market garden and truck crops valued at not over $200 an acre on Round, Cresap, and Wells bottoms which under present practices are planted almost entirely to field corn, wheat and hay, with a few acres of potatoes on each farm. Located as they are, within fifteen to thirty miles of Wheeling and but eighty-three to ninety-eight miles of Pittsburg, with a local

Fig. 9. *This View and Those Shown in Figures* 10 *and* 11 *are of the Same Market Garden Farm Located in the Ohio Valley a Few Miles North of Wheeling.*

railroad stop on every bottom, it seems an economic waste that such land is not put to a more profitable use. The same statement holds true to a somewhat less degree of thousands of acres further south which can be bought for from $50 to $150 an acre.

Labor Supply.

(One of the principal reasons for present practices is no doubt found in the lack of suitable farm labor).

Throughout the entire survey the farmers complained of the great difficulty they experienced in finding suitable help, even at $1.75 to $2 a day. The difficulty was most pronounced in the vicinity of towns and in communities where there has been oil development. In the Wheeling section, in which

the gardeners are mostly German or of German descent, the large families which are the rule, or partnerships made up of two or more brothers, have solved the labor problem to a considerable extent. In such cases, father, son or one of the brothers attends to the marketing end of the business, leaving the others at home to look after the growing end. A very

Fig. 10. *Some Land of This Character is Valued at* $3,000 *an Acre.*

noticeable feature in the distinctly rural parts of the valleys was the great scarcity of young men on the farms. Repeated instances were noted of owners of farms of considerable size who have retired from active farming operations either because of advancing age or because they have reached a financial position where it is not necessary to work so hard. In many cases they have large farms, (forty-five were noted of over one hundred and fifty acres) which they have either turned over to a tenant, would gladly do so if they could find a good one, or are simply getting along with as little labor as possible. Several expressed a desire to sell or rent their farms. It is a significant fact that out of the fifteen counties in the state the rural population of which decreased between 1900 and 1910, six were found in the region included in this survey. With their percentages of decrease they are as follows: Tyler, 11.4%; Pleasants, 13.6%; Wood, 11.4%; Jackson, 8.8%; Mason, 4.7%; and Cabell, 1.4%.

SUGGESTIONS BASED ON THE FINDINGS OF THE SURVEY.

Suggestions as to ways and means of increasing the development of the market gardening and trucking industries in the valleys included in this survey fall naturally into two general groups; first, those which have to do with problems of production and second, those having to do with problems of distribution. Not all of these problems are within the province of the Experiment Station, which has to do primarily with those of the first group. A full discussion of even these is beyond the scope of this bulletin. The problems disclosed

Fig. 11. *It is Only a Question of Time When Land Situated Like the Above Will Cease to be Used for Gardening Purposes.*

by this survey, however, are believed to be of enough value to the people of the state to warrant their brief mention, at least, in the hope that it may lead to further investigation and action by those agencies to whom the solution of the problems discussed properly belongs.

Problems of Production.

Obviously, the production of vegetables in this section can be increased by increasing the yield per acre and by enlarging the acreage planted to such crops. The first method involves the improvement of cultural methods in general, but,

in the opinion of the writer, the following are most needed in this section:

1. A more general use of leguminous crops such as cow peas, soy beans, crimson clover, hairy vetch, or alfalfa either for hay or as green manuring crops. Continual cropping without restoring the organic matter of the soils has depleted their humus content in many instances. The crops mentioned will yield a greater net profit than either corn, wheat, oats or hay in almost all cases and at the same time will add fertility and humus to the land. They should be made a part of the rotation on practically every farm devoted to the growth of truck crops.

2. A more general and more intelligent use of commercial fertilizers. Of the two hundred and seventy-one farmers interviewed, only one hundred and six made any use whatever of commercial fertilizers and many of these used small amounts, generally of low grade materials. Even those gardening in the neighborhood of the cities, who use large amounts of stable manure, would find it a profitable practice, in the writer's opinion, to use from five hundred to two thousand pounds of a high grade fertilizer to the acre. There is urgent need of demonstrating to the farmers in these valleys the value of fertilizers on truck crops. *

3. The more common use of spraying or other measures for the control of insects and diseases. A definite system of crop rotation is one of the best means of preventing injury from diseases.

4. The more general use of hot beds and cold frames for starting early plants of tomatoes, cabbages, peppers, egg plants, etc. This is one way in which the competition of the trucking sections further south of us can be met early in the season.

The increased production which would undoubtedly result from the above practices would be small indeed, however, compared with that which would follow the increased acreage which might well be planted to truck crops in this section.

*Experiments conducted by the Experiment Station in 1910 and 1911 at Letart and Salama showed that applications of a high grade commercial fertilizer used at the rate of 500 pounds broadcast and 500 pounds in the furrow gave a profitable increase in the potato crop. (See Biennial Report 1912.)

Table III shows that there are approximately 150,000 * acres of the best types of trucking soils available in the two valleys. Only a small percentage † of these are used for such crops even though they would unquestionably prove more profitable than the usual farm crops, the average gross value of which will probably not exceed $50 per acre. The question naturally arises, "Why then, have they not been more generally used for truck crops?"

From his observations and the answers given by the farmers to whom this question was put, the writer believes the following to be the principal reasons:

First, the natural conservatism of the farmer. Most of the farmers in the valleys have grown corn, wheat, and hay all of their lives. Truck crops are new to them. Not understanding their requirements and in many cases not realizing what an increase in revenue they could obtain from the culture of the crops under present market conditions they are slow to change what has so long been a common practice.

Second, the fact that our markets are flooded with southern stuff early in the season and *apparently* well supplied at all times has caused many farmers to believe that it is impossible to compete profitably with the outside growers. That such a belief is erroneous (as applied to all but the very earliest part of the season) will become quite clear to anyone who will make a study of his nearest markets.

Third, the cost of land. With the exception of the Northern Panhandle section already mentioned and near the other large cities where the demand for land for industrial and residential purposes has forced prices to such a level as to make them prohibitive for land desired for agricultural purposes, the price of land in the valleys is not at all excessive. With skillful management it will return a handsome percentage on the investment. While this is perfectly true, lack of

*40,656 acres are deducted from the total of all types in the first part of Table III to allow for areas that have ceased to be available for gardening purposes because they have been used for residential or manufacturing purposes.

†It was of course impossible, in the brief time at the disposal of the writer and Mr. Jeffries, to interview every man in the two valleys who was growing vegetables. It is believed, however, that the acreage secured (2168) represents not less than 75% of the area in the valleys devoted to such crops. This would make the total about 2890 acres.

capital needed to purchase, equip and operate a market garden or truck farm, doubtless deters many who do not already own land from going into the business. It is to be hoped that recent and future legislation relating to systems of farm credit may help to overcome this difficulty.

Fourth (and by far the most important reason of all) the lack of men to do the work. While it is true that in gardening as in all other lines of farming, great progress has

Fig. 12. *A Typical Example of the Industrial Development Which is Crowding the Market Garden Industry Out of the Northern Part of the Ohio Valley.*

been made in the devising of labor-saving tools, such as transplanting machines, riding cultivators, seed drills, wheel hoes, potato planters, sprayers and diggers, fertilizer distributors, manure spreaders, etc., etc., which enable the operator to do the work of many men, they have not reached the point yet where they will run automatically, and at the present time operators are extremely scarce and hard to get. The increased acreage in truck crops which can be made possible by the more general use of such improved machinery, while highly desirable, will be slow and relatively small.

Judging from present tendencies it is quite evident that any great increase in the acreage of vegetables will be slow in coming, if we are to depend upon those already on the land. They lack the necessary incentive. Most of them are quite

content as they are, and naturally so, for the majority of occupants are prosperous owners. Only fifty-eight of the two hundred and seventy-one farmers interviewed were renters.

In the opinion of the writer the development of the trucking industry in these valleys and incidentally their agricultural development in general will be brought about most quickly and successfully through the settlement of more people upon the land, either as tenants or owners; a class of people who can be induced to come into this section because they are made to understand the opportunities which it affords for the growing of truck crops. Some well-placed, definite advertising of these possibilities would doubtless bring the desired results.

Problems of Distribution.

At the present time such problems are not very pressing. With an increased development of the industry they will of course become more prominent. They will group themselves about such topics as; a better knowledge on the part of the grower as to the best markets available to him, of the kind of products these markets demand, the amounts they can safely handle, how the products should be prepared for market, and what kind of package they should be shipped in. Lack of knowledge on such points as these causes a great deal of waste every year.

Many instances have been recorded of shipments that have been sent to large centers to be immediately reshipped part way back on the same or slightly diverging lines, if not indeed into the same town from which they were originally sent—simply because the shipper did not know the capacity of his nearest market. Very often disastrous gluts occur in certain centers at the same time that there is a scarcity of the same product in other centers in the same general district—due in this case to ignorance of the available supplies on the different markets at any one time. Oftentimes the shipper loses money or gets meagre returns because he has failed to properly grade and pack his product or has not complied with the demands of his market in the kind of package he has used.

It is difficult for the individual grower, unless he is an unusually large shipper, to keep thoroughly posted on market conditions, to obtain the best service or most favorable rates

from the transportation companies, or to obtain the best prices for his products. Co-operation among the growers of a certain community or district in which the same kind or classes of crops are grown, is the modern solution of this problem and is in successful operation in scores of localities all over the country today.

Such co-operation, while practically impossible in the Ohio and Kanawha River valleys today, because of the scarcity of growers and the small amount of produce grown, would be the natural result of the proper development of this region.

CONCLUSION.

The facts which have been presented in the foregoing pages, is it believed, warrant the following conclusions:

1. There is already a market gardening and trucking industry of considerable magnitude carried on in the Ohio and Kanawha River valleys of West Virginia. The average returns from market garden and truck crops are much greater than those from the ordinary farm crops—corn, wheat and hay—that are commonly grown in the valleys.

2. The present development of the industry is very small when compared with the increase in production which is warranted by the larger returns and which is possible because of good markets, good transportation facilities and favorable climate and soil conditions.

3. While an increase in the amount of vegetables produced would undoubtedly follow better cultural methods, the use of labor saving tools, and the better adaptation of crops to the different soil types, *the chief hindrance to the development of the industry is a lack of people to farm the land.*

Considering the fact that the millions of dollar's worth of fresh and canned vegetables which are shipped into West Virginia every year have been grown on soils very similar to thousands of acres of land in the Ohio and Kanawha River valleys yet undeveloped; who shall say that the settlement of these lands is not worth the united effort of all the agencies that are interested in advancing the agricultural interests of West Virginia?